

Technical Note

Micro SMP-200

Recommendations for Intravenous Administration

INTRODUCTION

iPRECIO® is a completely implantable, programmable micro-infusion pump system for experimentation in small laboratory animals. The pump has a built-in microprocessor which can be programmed to administer small volumes, in vivo, for extended durations. Additionally, the pump houses a septum designed for percutaneous access, through which filling and exchange of solutions is made possible. The iPRECIO® system's highly precise, in vivo-, capabilities uses a patented, high accuracy, mechanical pump technology, the "Rotary Finger Method", which was developed by Primetech.

Continuous intravenous administration (IV) is one of the most flexible methods for introducing drugs for bio-medical research. Rapid drug responses, good control on delivery and dose (high doses as well) is more easily obtained when performing IV administration. PK studies may be carried out without hepatic first-pass effects and oral absorption issues.

IV administration requires more specialized equipment and technique/skill as it is necessary to access a blood vessel and ensure reliability of catheterization. It is further necessary to use an antithrombotic catheter to ensure long term problem free continuous infusion.

WARNING : iPRECIO® Micro – Infusion Pump is not intended for human use.

REQUIREMENTS

Perioperative Care

- Antibiotics and the treatments
- Anesthetic agents and the techniques
- Heating Pad
- Surgical glove, mask, cap and gown
- 70% Isopropyl Alcohol
- Disinfectant Soap
- Sterile saline
- Electric shaver or Hair remover

Pocket and Tunnel Making

- Surgical scissors and forceps
- Sterile scalpel blade with handle
- Trocar Sleeve Kit (metal trocar with plastic sleeve)

Pump Fixation

- 5-0 non-absorbable suture with curved needle

Intravenous Tube Fixation

- Cotton swab
- Microscissor or 23-gauge needle
- Intravenous catheter: FunnelCath™ PUFC-C30-10(3F to 1.2F) ; connect to 22ga swivel 7cm. (supplied by Access Technologies)

- Stainless coupler: Stainless steel tubing coupler 22ga × 8mm (supplied by Instech Solomon)

Wound Closing

- Wound clips and wound clips applier
- 3M™ Vetbond™ Tissue Adhesive (supplied by 3M) Perioperative Care

METHODS

1. Perioperative Care

Careful attention to sterile techniques and the use of sterile equipment are crucial to successful surgery. Additionally, antibiotics are most effective to administer pre- and post-surgery in order to maximize blood levels during surgery and recovery. Primetech recommends the use of a heating pad to prevent decreased body temperature in the peri- and post-operative animal.

2. Anesthetize the Animal

Anesthesia must be used to ensure a reliable experimental result. General anesthesia should be maintained for around 20 – 30 minutes. Primetech recommends using an anesthetic method that supports prompt post-operative recovery.

3. Catheter Attachment ⋯See Fig.1

1. Cut the outlet tube around 5cm under sterile conditions.
2. Connect the coupler into the tip of the tube.
3. Cut the antithrombotic catheter around 10cm and connect to the outlet tube with a coupler.
4. Fill the solution to the tip of the tube.
5. Activate the pump.

4. Pocket Making ⋯See Fig.2

1. Position the animal in sternal recumbency on the heating pad.
2. Remove the hair from the incision site and scrub with disinfectant soap and isopropyl alcohol. A series of three scrubs with both the disinfectant soap and alcohol is recommended.
3. Using a scalpel blade, make a 4cm midline incision through the skin on the thoracic vertebrae.
4. Using blunt dissection, create a pouch under the skin from the point of the incision to the caudal area by separating the skin from the underlying tissue with scissors.

The pocket should be the appropriate size (not too large and not too small) for pump fixation, low-stress implantation for a successful long-term infusion.

5. Tunnel Making ⋯See Fig.2

1. Position the animal in dorsal recumbency on the heating pad.
2. Remove the hair from the incision site and scrub with disinfectant soap and isopropyl alcohol. A series of three scrubs with both the disinfectant soap and alcohol is recommended.
3. Using a scissors, make a 2cm midline incision through the skin on the neck. Gently separate the skin from the muscle by blunt dissection with a scissors.
4. Position the animal in lateral recumbency on the heating pad.
5. Using the metal trocar sleeve kit, tunnel subcutaneously from the dorsal pocket to the neck skin incision.

6. Access to Intravenous †††See Fig.3

1. Position the animal in dorsal recumbency on the heating pad and face toward near side.
2. Tunnel the outlet tube subcutaneously from the dorsal pocket to the neck incision via/through the trocar sleeve.
3. Isolate the jugular vein from the peripheral tissue using forceps or a cotton swab.
4. Pass three surgical sutures (A, B, C) around the jugular vein. The cranial suture (A) will be used to completely occlude blood flow. The middle suture (B) will be used to hold the catheter in place after cannulation. The caudal suture (C) will be used to temporarily occlude blood flow.
5. Tie a secure knot around the vein using suture (A) to ligate the vessel.
6. Apply tension to suture (A) and tape the suture tails to the surgery table.
7. Make a loose knot on suture (B), and tape the suture on one of the tails.
8. Make a loose knot on suture (C), and clamp the suture tails with hemostat.
9. Gently apply tension to suture (C) using a hemostat to occlude blood flow.
10. Using a microscissor or 23 gauge needle, catheterize caudally;
 - I. Using a microscissor
 - i. Make small “V” cut into top of vein.
 - ii. Lift up “V” flap to open hole for easier insertion.
 - II. Using a 23 gauge needle
 - i. Prepare a catheter introducer by bending the beveled tip of a 23-gauge syringe needle. Hold the syringe needle with the beveled side facing up. Grasp just the beveled area of the needle with a needle holder and bend the tip downward to an angle of approximately 90°. (See Figure 3) The syringe needle may be placed onto a 1 cc syringe to be used as a handle to hold onto the needle and allow for a clear view of the surgical area.
 - ii. Using the 23-gauge needle as an introducer, pierce the vessel just proximal to the ligation suture (A) and insert the catheter caudally. Once the catheter is inserted into the vessel, withdraw the catheter introducer.
11. Secure the catheter to the jugular vein with suture (B) by gently pulling the loose suture tail.
12. Once the catheter is secured, release the tension on suture (C) and advance the catheter around 12mm beyond suture (C).
13. Tighten suture (B) and (C) around the catheter.
14. Release the tension on the ligation suture (A) and tie the loose ends around the catheter to help anchor it in place.
15. Trim all suture tails as short as possible.
16. Close the skin incision with 5-0 non-absorbable suture or wound clips. Once closed, seal the incision with Vetbond™ tissue adhesive.

7. Pump Fixation †††See Fig.4

1. Place the pump into the pocket.
2. Suture the pump to the muscle layer.

Over tightening of the sutures may induce tissue necrosis and laceration due to compression.

8. Wound Closing

1. Close the skin incision near the pump with 5-0 non-absorbable suture or wound clips. Once closed, seal the incision with Vetbond™ tissue adhesive.

Proper pocket closing will help in wound healing and help to prevent makes infection.

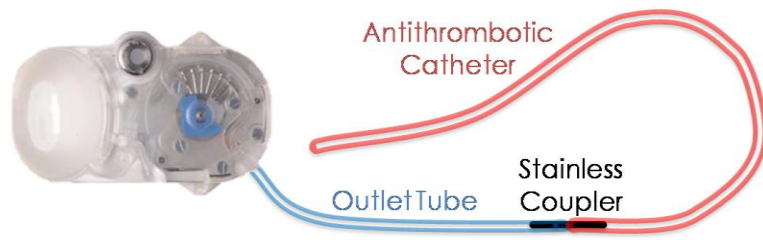


Fig.1 Connect the antithrombotic catheter

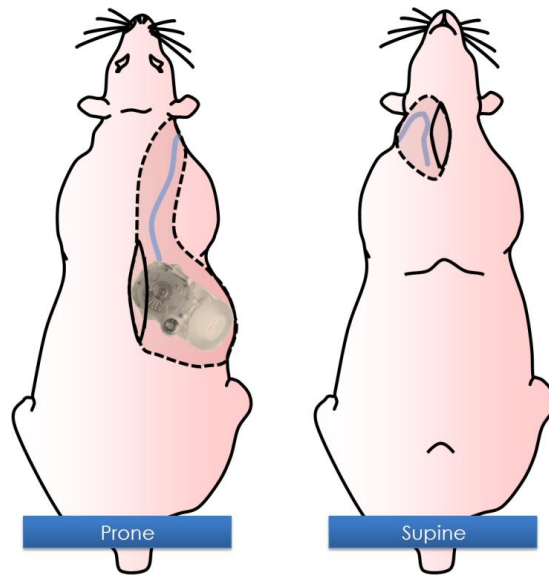


Fig. 2 Dimensional drawing of the pump pocket and tunnel

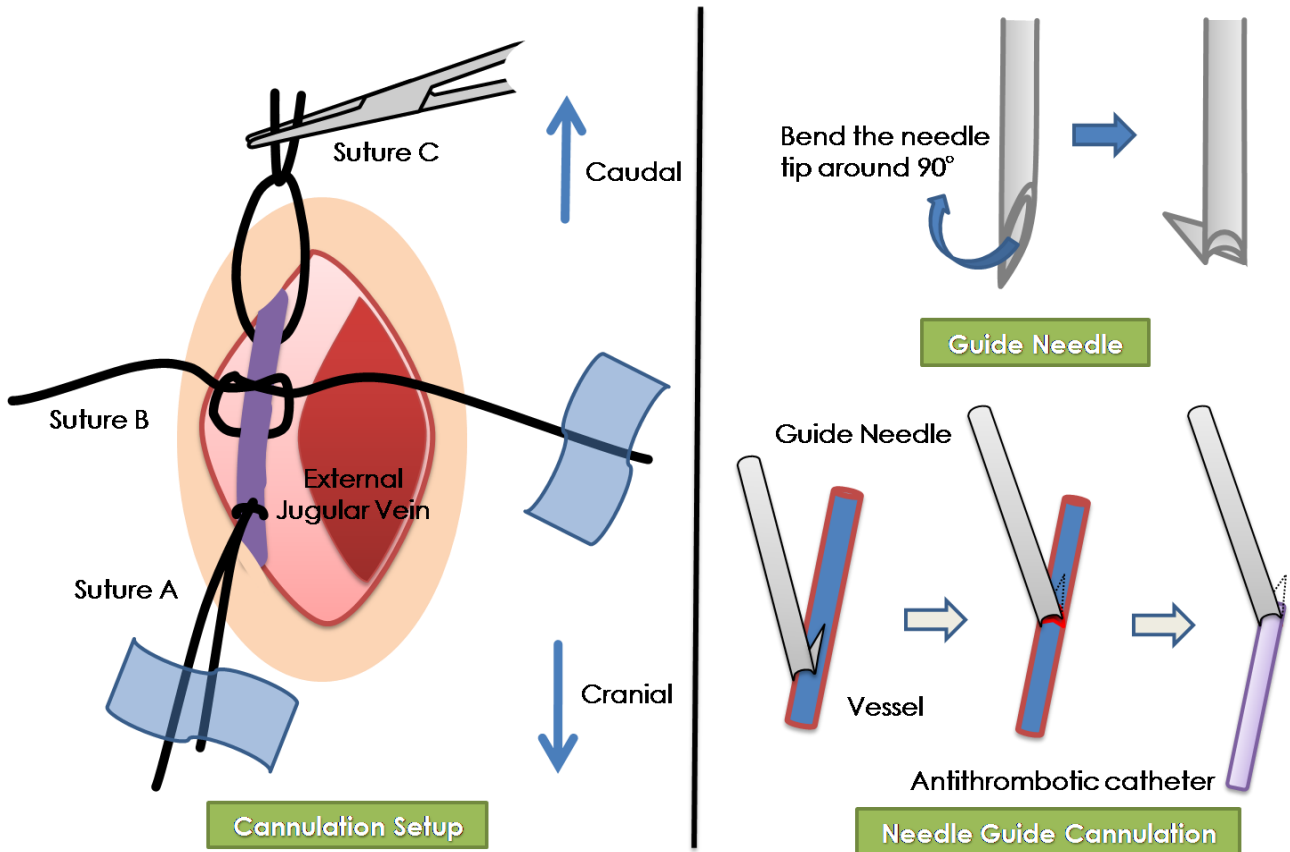


Fig. 3 Cannulation setup and needle introducer

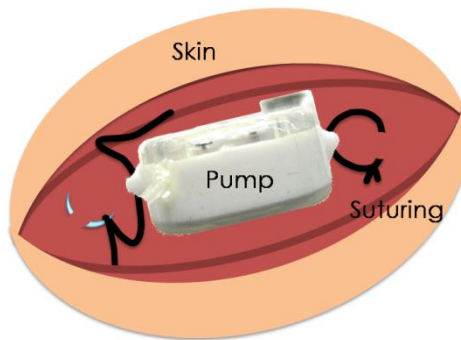


Fig. 4 Pump Fixation: View from the back of the pump with septum port on the right hand side.

REFERENCES

Rat Jugular Vein and Carotid Artery Catheterization for Acute Survival Studies, A Practical Guide. Angela Heiser, Foreword by John H. K. Liu. Springer

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Innovative drug infusion technology for laboratory animals.



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